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Platform urbanism, smartphone applications and valuing data in a smart city

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Recent scholarship on smart cities and platform urbanism has explored the very wide range of data harvested from urban environments by digital devices of many kinds, analysing how not only efficiencies but also profits are sought through the extraction, circulation, transformation, commodification, integration, and re-use of data. Much of that data is generated by smartphone applications. This paper looks at the design of a group of eight smartphone apps by a range of different actors in Milton Keynes, a small UK city with a large number of smart city initiatives. The apps are understood as a co-constitutive interface between data circulations and embodied users. The paper focuses specifically on the data that the apps generated and shared and on how the app designers anticipated that the data would create different kinds of value for embodied app users. While some data circulations were understood as ways of generating financial value, the paper argues that a number of other forms of value were assumed in the app design. The paper identifies two of these, which it terms normative values and interactive values. It examines how the data mobilised by the smart city apps enacts particular versions of these values, and how those values co-constitute specific kinds of bodies, agencies, and geographies in digitally mediated cities.

KEYWORDS

data circulation, embodiment, mobility, smart apps, value

1 | INTRODUCTION

It is now clear that in many parts of the world, much of urban life is digitally mediated. In urban studies, recent discussions of this phenomenon have focused on the so-called “smart city,” in which a city authority (often in partnership with private companies) collects, integrates, and analyses big, geolocated, real-time digital data, in order to manage its city more efficiently and sustainably (Batty, 2016; Marvin et al., 2016; Schindler & Marvin, 2018). Recent scholarship is focusing on a much wider range of organisations which use digital devices of many kinds to harvest data from urban environments, however, analysing how not only efficiencies but also profits are sought through the extraction, circulation, transformation, commodification, integration, storage, and re-use of data. This broader context of the “colonization of the [urban] lifeworld through the commodification and extraction of personal information as data” (Thatcher et al., 2016, p. 992) can be understood as part of what has been called “platform capitalism,” in which financial value is extracted from the collection and analysis of data (Srnicek, 2016). Discussions of big data in smart cities have thus been joined by discussions of “platform

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urbanism” (see for example Barns, 2020; Fields et al., 2020; Lee et al., 2020; Leszczynski, 2019a; Richardson, 2019; and see the special issues edited by Rodgers & Moore, 2018 and Sadowski, 2020).

Discussions of platform urbanism have so far tended to focus on how large digital platforms like Uber and AirBnB are reconfiguring the everyday infrastructures of many cities worldwide by sharing data with and about different users. Impelled by Barns's reminder of the need to “remain alert to different registers of socio-spatial experience, encompassing but also extending beyond ontologies of control and appropriation” (2020, p. 20), this paper sidesteps the big platforms and the global corporations, however, and discusses some rather unsuccessful efforts at circulating data in an ordinary city in middle England: Milton Keynes. That is, it starts from an “actually existing smart city” (Shelton et al., 2014) and its reliance on winning short-term, project-based resource from a variety of funders to develop smart activity (Cowley & Caprotti, 2019; Cowley et al., 2018). The paper looks at the design of a group of eight smartphone applications by a range of different actors in that city. None of the apps proved to be part of the next big platform: indeed, only four made it to an app store and two of those temporarily. While this example of smart city activity may appear somewhat underwhelming, this paper argues that it does nonetheless provide three significant insights into smart, and platform, urbanism.

The first of these concerns the value of data in smart and platform cities. The integration of data generated by smartphone apps into databases is an important means by which data in a smart city are generated by both companies and city authorities (Dieter et al., 2019; Schwanen, 2015; Thatcher, 2017; White, 2016). Hence apps are created as part of many smart city projects (Abella et al., 2015; Dutta et al., 2019; Kitchin, 2014; Pereira et al., 2016; Shwayri, 2019). Apps are also integral to platform urbanism because they generate much of the “data exhaust” that is harvested by platforms large and small (Barns, 2020; Lee et al., 2020; Thatcher, 2017). Put crudely, data are both delivered and generated through apps, and this paper approaches apps as nodes in wider circuits of data exchange. Thus far, the value of this circulating data has been understood by scholars of smart and platform cities mostly in the context of technocratic forms of urban management and of the political economy of platforms. That is, the values generated by apps have broadly been understood in terms of calculation and commodification (Halpern, 2015; Krivý, 2016). However, the eight apps discussed here were designed to enact a more diverse range of values. The first contribution of this paper, then, is to argue that the production and circulation of data via apps may enact not only the values of platform capitalism but also other forms of value.

The paper's second insight concerns how those values constitute specific kinds of app users. Interacting with apps is always embodied (Bonner-Thompson, 2017; Miles, 2017; Richardson, 2019). Apps – installed on smartphones, accompanying people at every moment of their everyday life, their use mundane, repetitive, and habitual – are “functional and sensorial prostheses” for very many bodies (Smicek, 2014, p. 83). Many feminist, crip, queer, and critical race scholars insist on “the insolvent place of the body in relation to new media technologies” (Munster, 2006, p. 12) and on the need for work that attends to the co-production of embodiments with urban digital technologies. Barns (2020, p. 157) too argues that the “intimate entanglements” of smartphones, their apps, their data, and their users are central to urban platforming. To date, however, there has been little discussion of apps, bodies, and data in smart and platformed cities (though there have been important criticisms made of the distribution of profits and the precarity and exploitation of those who use platforms for waged work [see, for example, Richardson, 2019]). Through its focus on apps, on apps' data circulations, and on the values enacted in those circulations, this paper also attends to the specific form of embodied human agency assumed in the design of smart city apps. It suggests that the fleshy body cannot be understood simply as an app's passive wetware host because the values enacted as apps' data circulate co-constitute particular kinds of embodiment. This is the paper's second point, then: discussions of data in smart and platform cities need to address embodiment because different kinds of app data circulations value different bodies differently.

Both of these insights entail a third: the need to be attentive to different kinds of geographies. The spatial vocabulary most often used to understand the political economy of urban digital data circulations describes a “conjunctural” geography of simultaneous “embedding” and “disembedding” (Graham, 2020), or “recentralisation” and “decentralisation” (Richardson, 2020); that is, the geographies of apps are divided into the “front end” of everyday use and the “back end” of data circulation (Boichak, 2019). The notion of “front end” and “back end” is helpful in describing some of the geographies of how apps and platforms work, for sure (particularly the opacity of the back end to app users [Barns, 2020]). But this paper suggests that other geographies are also rendered as data circulations enact value. One, in this case, is a strong sense of place identity. Another is a spatiality of mobility, flow, and connection, which are central themes in smart imaginaries (Leszczynski, 2019b; Luque-Ayala & Marvin, 2016; Rose, 2018). The point here is that the organisation of space (and time: see Datta, 2020; Kitchin, 2019), as it emerges from devices and values of smart and platform cities, is multiple, and that understanding the reconfiguration of urban spaces and embodiments by platforms and big smart data requires a more expansive spatial vocabulary (Rose, 2017, 2020).

The paper therefore uses an empirical analysis of eight smart city apps to suggest that the conceptualisation of smart and platform urbanism should be extended. Data circulations can generate diverse kinds of value, embodiment, and geography. The next section discusses the paper's conceptual approach to data, apps, and embodiment. It argues that, given that apps ensure that the data circulations of platforms interface intimately with bodies, attention should be given to the forms of embodiment co-produced with app data, and to the ways different bodies are valued differently. It develops a heuristic distinction between the discursive normative values attached to specific kinds of data circulations, and the value generated by the anticipated forms of interacting with that data. The next section discusses the paper's case study and briefly describes its methods. The paper then describes the normative and interactional values generated with the apps' data. The paper concludes by arguing that smart and platform data circulations are not just reconfiguring urban fabrics, urban governance, urban infrastructure, and urban labour: they are also reconfiguring the bodies that can inhabit these platformed cities and the spatial organisation of those cities.

2 | SMART CITIES, PLATFORM URBANISM, AND THE VALUE OF DATA

The gathering and analysis of data to improve life in cities has a long history (Barns, 2020; Halpern, 2015; Krivý, 2016). Geographers started paying attention to roles of digital data in urban spaces some time ago (Crang, 2000; Graham & Marvin, 2001), but since the emergence of the "smart city" as corporate product, city policy, and urban brand in the early 2010s, significant attention has been paid to the "smart city" and its data circulations. Much of this attention has been critical. Many critics, geographers prominent among them, have challenged the technocratic forms of urban governance that such claims presume (see, for example, Cardullo & Kitchin, 2019; León & Rosen, 2020; McNeill, 2015; Vanolo, 2014; Wiig, 2016). Their unaccountable surveillance of individuals and populations has been emphasised (Browne, 2015; Jefferson, 2017; McNeill, 2015; Sadowski & Pasquale, 2015), while others have challenged the specifics of their database design and algorithmic processing (Amoore & Poitukh, 2016; Giesekeing, 2018; Kitchin, 2014; Leszczynski, 2016; Shelton, 2017). The agglomeration of data via urban platforms has also been heavily criticised. Attention has focused on how that data enacts "an asymmetric power relationship in which individuals are dispossessed of the data they generate in their day-to-day lives" (Thatcher et al., 2016, p. 990). Thatcher et al. (2016) describe this dispossession as "data colonialism." They point not only to how profit is made from individuals' data by corporations and not individuals; they also show how such data quantifies and surveils urban life as "previously private times and places are commodified and privatized as a new terrain for capital investment and exchange" (Thatcher et al., 2016, p. 991; and see, for example, Sadowski & Pasquale, 2015; Schindler & Marvin, 2018). It has also been noted that platform users do not properly profit from their sharing of data (Barns, 2020; Graham, 2020; Richardson, 2020).

There is a strong account, then, of how commercial platforms extract and commodify data in cities. Some of this work has a tendency to conflate smart cities and platform urbanism, particularly work that focuses on smart corporate hype or on new-build smart cities (Leszczynski, 2019a). They are not quite the same thing. Platforms tend to describe themselves as innovative disruptors (Barns, 2020), and in many cities they have a different relationship to urban policy-making and governance than smart city projects.

Compared to the systems associated with smart cities, platform urbanism is characterized by being more directly connected to consumers and interactive with users, more intent on rapid scaling-up via network effects and venture capital, and more antagonistic to government regulations and incumbent industries. (Sadowski, 2020, p. 2)

The digital mediation of many cities thus consists in part of complex and extensive "intermediations" between smart projects and platforms in which "the city itself is rendered as a platform ecosystem" (Barns, 2020, p. 121).

Barns's (2020) account of platform urbanism is a sustained analysis of how data circulate in many forms as they are created, aggregated, processed, and redistributed. As different kinds of data transactions occur, different values are produced through both material and discursive practices and processes. As data move between different devices, softwares, servers, and users, one of the values produced is exchange value, when data are transacted in commodity form. But other forms of value are also enacted in this circulation. Barns herself cites Gibson-Graham's (2006) project to rethink and remake the economy in alternative terms as inspiration for her nuanced account of the complexities of intermediated smart and platform urbanism, as she explores the ongoing power of both discourses and practices of "openness" as well as "disruption" to urban platforms (Leszczynski, 2019a). Others have identified yet more forms of value embedded in platforms: trust

(Leszczynski, 2019b), beauty (Halpern, 2015), sharing (John, 2013). This paper too assumes that data circulations can enact different kinds of values.

In their feminist accounts of platforms, Leszczynski (2019b) and Barns (2020) are both alert to the imbrication of app interfaces with forms of embodiment. As the introduction remarked, smartphone apps accompany many bodies everywhere; phones and their interfaces generate data and are also sites where data are encountered. Critical work on the co-production of bodies with big digital data has focused on both the “back end” algorithmic reproduction of racialised and gendered bodies (Eubanks, 2017; Jefferson, 2017; Leszczynski & Elwood, 2015; Noble, 2018) and on the “front end” of everyday co-production of embodiment with smartphone apps (Bonner-Thompson, 2017; Miles, 2017). In both cases, it is clear that the aggregation and analysis of specific data co-constitutes different kinds of embodiment. To understand this process better in the case of smart city apps, the example of self-tracking is helpful (Kristensen & Ruckenstein, 2018; Lupton, 2016; Neff & Nafus, 2016). Self-tracking apps and devices monitor specific aspects of their wearer's bodies: the number of steps taken daily, their heart rate, sleep patterns, calorific intake, and so on. These data are uploaded and stored for reference by the user and are shared with other users. The apps use “highly specific modes of measurement that tend to seek to quantify [specific] practices and properties and render them more visible than other bodily attributes” (Lupton, 2018, p. 8), and these data (as well as comparisons with the data of others) are used to reconfigure those embodied attributes by the self-tracker (for example, by doing specific exercises or eating differently). Hence “people and their data make each other” (Lupton, 2018, p. 5).

Work on self-tracking certainly intersects with critiques of the political economy of platform data extraction, since many self-tracking apps sell the data they harvest from users. Drawing on Kristensen and Ruckenstein's (2018) account of self-trackers in particular, however, it is possible to identify two other forms of value generation as bodies interact with apps. According to Kristensen and Ruckenstein, data in the form of numbers and visualisations are generated, monitored, and evaluated by the self-tracker for whom “the use of metrics resonates with whom they aspire to become” (2018, p. 3637). For self-trackers, experimenting with data generates and amplifies a sense of autonomy. Thus Kristensen and Ruckenstein (2018) distinguish analytically between the value generated by the *form* of interacting with data and the valorisation of a *norm* which gives those interactions significance. This careful specification of what is done with apps' data by users speaks to this paper's concern to consider the diverse forms of value that can be enacted in various kinds of data practices and discourses. It is a distinction elaborated in the analysis that follows. Before that though, the next section discusses the paper's case study.

3 | METHODS AND MILTON KEYNES

There are a number of approaches to the study of apps. Some pay more attention to the “front end” of apps: to the affordances of the app's screen interface (Ash et al., 2017; Light et al., 2016), or the interaction of the app's affordances and its human user which creates “the app-and-person entity” (Schwanen, 2015, p. 685). Other approaches embed apps in broader infrastructures which take more account of the “back end” of data circulation (Dieter et al., 2019). This paper approaches apps as designed interfaces through which data move, from front end to back end and back end to front, as smartphones accompany bodies and are held, swiped, and tapped. Its main source of evidence is interviews with individuals who designed or commissioned an app as part of a smart city project, or who were involved in discussions about what an app could or should do. The paper focuses on what they said about the design of the app and its data; as Neff et al., (2017) note, software designers and data scientists are reflexive about their design decisions so their talk should be understood as part of their design work (see also Light et al., 2016, p. 883). The paper draws on 27 interviews with council officers, software developers, marketing managers, workers in voluntary sector organisations, IT project managers, workshop participants, and self-motivated advocates for a particular cause. The interviews were recorded, transcribed, and analysed to identify “the app's vision, operating model and governance as investigative work that stakes out the app's *environment of expected use*” (Light et al., 2016, pp. 2–3). The interviews give a rich and complex account of the assumptions underlying the apps.

The 27 interviews were part of a larger research project looking at different smart projects in the UK city of Milton Keynes (MK). MK is halfway between London and Birmingham and was founded as the last of the UK's post-war new towns in 1967. It has a long history of urban innovation, particularly around sustainability, and in recent years the city's council has made a number of successful bids for smart city projects. Two of the largest have been £150 million in 2013 for a transport innovation centre, the Transport Systems Catapult (TSC), and MK:Smart. MK:Smart was awarded £8 million by the Higher Education Funding Council for England between 2014 and 2017, and match funding commitments from a range of corporate partners resulted in an overall programme value of £16.7 million (Valdez et al., 2018). A third

significant investment was the £3 million VivacityMK project in 2018, which installed sensors to monitor and manage traffic flow and car parking spaces across the city, funded by InnovateUK and commercial investors. As well as these large smart projects, both the TSC and MK:Smart facilitated many smaller smart projects in partnership with other organisations, both local and national, including charities, voluntary sector organisations, and local campaigners. Eight of those projects generated smartphone apps, and these are the eight apps discussed in this paper.

The context of MK is important. Much discussion of smart cities has focused on new-build cities or neighbourhoods like Masdar, Songdo, PlanIT Valley, Sidewalk (Toronto), or Hudson Yards (New York), or on cities with physical control centres like Rio de Janeiro. However, it has become increasingly obvious that smart activities in existing urban environments more often consist of multiple stand-alone projects dependent on time-limited funding, from a range of funders, and with different forms of governance and accountability, often understood and designed as “experiments” (Evans et al., 2016). As a result, there is often little co-ordination between these projects; integrating their data is also challenging (Schindler & Marvin, 2018). Indeed, the diversity of funders and actors in MK’s smart activity provided evidence for the variety and ephemerality of much actually-existing smart city activity identified by Cowley and Caprotti (2019). The apps under discussion here reflect this piecemeal smartness. Two of the apps discussed in the paper never got beyond prototyping because their funding finished; another was made redundant by the development of Google Maps; and only two appear to have been updated since their initial design.

Apps are nonetheless central to digitally mediated urbanism. The “appification of everything” was announced in the *Wall Street Journal* in 2010 (Hay, 2010), and in the decade or so during which online smartphone application stores have existed, apps have proliferated to an extraordinary degree. There are now millions of apps available to download, in multiple stores, for all sorts of digital devices, and their integration with other networks, trackers, and platforms is also highly diverse (Dieter et al., 2019; Morris & Murray, 2018). All the major user-facing platforms have apps, of course, but app stores also carry many locally specific apps. A search on Apple’s Appstore and Android’s Google Play in March 2019 using the search term “Milton Keynes” generated 85 unique apps, and broadly speaking they fall into two types: apps that convey local information, and apps that focus on embodied activities (sometimes both). Nine of the 85 app store MK apps invite the user to improve their physical wellbeing, including apps from hair and beauty salons as well as apps that encourage physical fitness. A second group of 22 apps includes apps to buy food and drink from restaurants and takeaway businesses, and shopping centre apps. There are 11 apps for transport in MK, ranging from taxi apps to local public transport and parking apps. Another group of 12 apps support activities users will pursue in their recreational time, such as apps for the local football team or apps that encourage residents to explore MK’s heritage and culture. Twenty-two apps offer information to the user, mostly news apps and apps that provide information on businesses, and a further eight directly educate the app user or indirectly support their learning. One app is designed for the employees of MK Council. There are MK-focused apps for a lot of different things, then, but over half are mediating embodied forms of activity – eating, fitness, mobility, beauty – and almost all the rest offer information.

The eight smart city apps fit into this broader pattern of MK apps. The eight apps are Motion Map, Breastfeeding Hub, Redway Reporting, Garden Monitor, Eyeware, MyMK Heritage, MK:3D, and Age Friendly Map. The first four were facilitated through the MK:Smart project. Motion Map was part of MK:Smart from its inception and aimed to support and influence how people moved around the city by offering real-time information on transport options so that app users could choose the most convenient but also the least carbon-intensive mode of transport (Valdez et al., 2018). The Redway Reporting app and the Breastfeeding Hub both emerged from the Citizens Work Package of MK:Smart, which facilitated local digital innovation. The former allows problems with the city’s 200 km of cycle and walking pathways to be reported to the council. The latter carries information about breastfeeding and also encourages users to rate locations in the city according to how welcoming they are to breastfeeding. The Garden Monitor app was a side-project for MK:Smart’s lead data scientist, who is a keen gardener, and was intended to optimise garden watering using data on weather and soil conditions. The Age Friendly Map app was a collaboration between MK Gallery, Age UK Milton Keynes, and a local digital design company, and aimed to make the city centre more accessible to older people by giving them information about the city centre that was relevant to their needs. The Royal National Institute for the Blind collaborated with the TSC to produce the Eyeware app, which allows users to experience different forms of visual impairment. MyMK Heritage was a collaboration between the council and the city’s Arts and Heritage Alliance; it is a geocached walking tour around some of the city’s historical landmarks which displays information about the landmarks when the app is nearby. The MK:3D map was a collaboration between Virtual Viewing and Milton Keynes Council; using touch gestures, it allows users to move over a 3D model of the city and pause over locations to get information about the location and its employment and investment opportunities. Only the Breastfeeding Hub and Eyeware remain in the app stores at the time of writing; the others were either

prototypes or have been taken down. Only MyMK Heritage and the Breastfeeding Hub appear to have been well-used locally (the latter now has clusters of users beyond Milton Keynes).

As noted above, many commentaries on smart and platform data circulations assume a model of platform urbanism in which data become valuable in the form of a commodity to be bought and sold. Interviews about these MK smart apps reveal a rather more complicated picture. In particular, the commodification of user data was never their planned business model. Indeed, only two of the eight apps had (partly) commercial goals. While in both cases their developers understood data as of financial value, in neither case was this generated by the commodification of data. One of these two apps was MyMK Heritage. However, it would not gather data to be aggregated and sold on. Rather, the data would be used to quantify and demonstrate the value of the app. In the words of its developer:

We want to see how many miles someone's walked so that we can see the type of effect that our application is having. There are lots of advantages to what you can then do with that information and, depending on how we take the project forward and the places that we go, from a public health perspective, it will be interesting to capture that data on how far people are walking. I think it makes our application a lot more valuable if we can generate some detailed analytics afterwards.

The other MK smart app with clearly commercial ambitions was the Motion Map. At the time of their interview, two of the Motion Map developers were attempting to sell a version of Motion Map to another city council in the UK. Their business model was that Motion Map would be paid for by users paying the developers a fraction of each ticket sale in exchange for data about their buses. They went on to suggest that the other affordance of the app's data that might be commercially viable was its ability to display available car parking spaces: a service that drivers might be prepared to pay for.

These two apps were concerned to make profit from their data. However, they demonstrate that data can be commercially valuable in ways other than extracting big (or even small) data from smartphones and selling it as a commodity. Data can be used as evidence for the app's efficacy, increasing the app's appeal to potential buyers, for example. And the app can also be profitable by providing a paid data service to various users. The paper now turns to the other six apps, none of which were designed to generate financial value, and explores what other values were embedded in their design.

4 | SMARTPHONE APPS, DATA, AND NORMATIVE VALUES

The second section of this paper developed a heuristic for understanding the values generated with these eight apps and their data. It distinguished between the value generated by discursive norms and that generated by embodied forms of data interactions. This section explores the normative values which app designers in MK anticipated in their smart city app.

All but one of the eight smart city apps in MK provided data (in the form of information) to users for free (the exception was the Redway Reporting app). Six of these assume that such data can be given without expectation of profit, in order to achieve a collective good. The Breastfeeding Hub was designed in part by a local midwife who was a strong advocate of the health benefits of breastfeeding. Apps providing data so their user could use as little water as possible in their garden (Garden Monitor), or travel the most carbon-efficient route (Motion Map), were driven by commitments to sustainability. The Eyeware app assumes that having some sort of experience of visual impairment would increase understanding of the experiences of visually-impaired people. Even the designers of the MyMK Heritage app had other aims that were not commercial. Its designers were keen to discuss how the app enabled people to unlock information about the city and then, with what they had learnt, to engage in the city in the future:

it's a good catalyst to go out and try something and do something and learn something [...] raising awareness of what's here [...]. that thing about if you're going to get people engaged and get the younger generation interested in this town and why it is the way it is and how and in the future of, you know, continuing to build it. It's only 50 years old, there's a lot of development to happen yet. (Council officer)

And in the case of the Redway Reporting app – which asks users to generate information – its designers were motivated by a desire to encourage more cycling for health benefits and urban sustainability. None of these apps commodify data. Rather, data are made available in order to enhance something valued as a personal or collective good: health, sustainability, learning, and local identity. These are the normative values which the apps' data are anticipated as enacting.

This confirms Cowley et al.'s (2018) discussion of the importance of what they call "civic publicness" to much UK smart city activity. In the case of MK, this was constituted in part by the agendas of funders (MyMK Heritage, for

example, was partly funded by the Heritage Lottery Fund, which meant it had to have an educational outcome). It was also part of a widely shared commitment to improving MK as a city. As one of the academics involved in the citizens work package of MK:Smart said, “the whole remit of smart cities is to benefit the citizens of the city across the piece.” And commitment to the civic good aligned in several interviews with a strong sense of MK as a particular kind of place where urban wellbeing was achieved by experimentation and innovation. This MK discourse was audible in several interviews, most clearly from the app developer who worked on the MyMK Heritage app:

for me, the thing I always take from Milton Keynes is, actually, it's not made up of grid roads, or it's not made up of roundabouts, or landscape, or trees. For me, it was made up of an attitude of ‘we can do it’ and we can do it our way [...] I always have enormous respect for that ethos, if you like, and that's what I take from how Milton Keynes was built and how I would really like to see it continue to grow in the future.

This feeling that “we can do it our way” is articulated and shared in MK in a number of ways. Urban policy makers, politicians, academics, and planners are aware of the city's history as a testbed of innovation, and often refer to it in their talk about the city. It informs a number of council policies, including transport and economic growth (Valdez et al., 2018), and the MK2050 vision document produced in 2017. Local organisations like the Fred Roche Foundation have held events about aspects of urban planning and design for many years in MK, to large local audiences. There is the ongoing role of MK Gallery in playing with arts-based urban experimentation. And there is a wide range of smart city projects. One of the values of MK's smart city apps, then, was their rendering of MK as an innovative city. Indeed, even after Motion Map was made redundant by Google Maps, MK representatives continued to showcase it at smart city expos and events as an exemplar of the city's inventiveness (Valdez et al., 2018). The normative valorisation of civic publicness shared by these apps' designers draws on and reproduces a particular sense of place identity.

This section suggests that not all smart city apps are built on the same commercial model as urban platform apps, then. It has argued that many smart city apps enact quite different values as their data move from front end to back end and back again: health, sustainability, learning, and local identity. This returns us to Sadowski's (2020, p. 2) point that smart city data circulations are not the same as platform circulations. For example, in MK, not all the smart city apps were designed to rapidly scale up; many were focused just on the city. Their use was intended to enhance the civic public good. Hence they were not necessarily antagonistic to government, since many shared the council's commitment to improve MK through innovation. Like platforms though, they were designed to connect directly to users, through their data. The next section turns to the anticipated forms of users' data interactions.

5 | SMARTPHONE APPS, DATA, AND VALUING EMBODIMENTS

The previous section explored the normative values which app designers drew on to explain apps and their data. This section suggests that the values enacted by apps' data circulations is not only a question of the norms that make such circulations meaningful and important, however. Rather than focusing on what normative good was supposed to follow from the apps' data, this section pays attention to the values enacted in how users were understood to interact with the data. As well as Kristensen and Ruckenstein's (2018) discussion of self-trackers, this section builds on recent work attentive to the “material-discursive orientations through which individuals and collectives become attuned, predisposed, and/or incentivized towards using, contributing to, remaining within, and/or returning to platforms” (Leszczynski, 2019b, p. 2; and see Ash et al., 2017). These “orientations” are often conceptualised as affective: feelings of connection, sensations of immediacy and real-timeness, swipe and flow (see, for example, Kitchin, 2019; Leszczynski, 2019b; Rose & Willis, 2019; Thatcher, 2017; Wilson, 2014). They point to the character of how apps and data are interacted with and this section argues that they also generate value.

One interactional value follows very directly from the previous section's discussion of the discursive norms that the eight smart apps were anticipated to enact. All the app designers assumed that better user behaviour – more healthy, better informed, more sustainable – would result directly from the provision of data. This is the logic implicit in the council officer's description of the MyMK Heritage app quoted in the previous section: she assumed that enabling people to unlock information about specific sites in the city would create more engagement with the city in the future. Another example of this logic is the Breastfeeding Hub app. The Breastfeeding Hub assumes that more parents will breastfeed if they have information about where it feels comfortable to breastfeed in MK in public. The app generates this information by allowing breastfeeding parents to rate locations in MK according to how comfortable they feel breastfeeding there. Thus, the assumption is that the right kind of information will enable more access to more places and hence more breastfeeding. This

emphasis on accessing information as a means of generating specific behaviours assumes that predictable, desired behaviours will be generated by appropriate information. Similar assumptions are also made in much work on transport choices, and underpinned the design Motion Map app. That is, the form of interaction with data assumed to generate goods such as sustainability or learning creates value only from and for a specific kind of engagement with data: trusting, rational, self-interested. Indeed, a lot of talk about smart cities – not just MK – assumes that the user interacting with data is “resource man” who makes rational data-driven decisions focused on maximising efficiency (Strengers, 2014; Thatcher, 2017). While this version of agency has been critiqued in feminist analyses of smart initiatives (Watson, 2017), it seems to remain central to the expectations of how these apps will be used.

As well as a certain kind of analytical interaction with data, a specific kind of corporeal experience was also repeatedly assumed in the interviews about user interactions with the eight smart city apps in MK. Every one anticipated making its user (more) mobile. Just like data, the app user had to be on the move – or if already mobile, more so. Five of the apps explicitly aim to facilitate corporeal mobility through urban space: the MotionMap and the Redway Reporting app are intended to improve travel experiences; the Breastfeeding Hub and the Age Friendly app were designed to make the city more accessible to breastfeeding parents and older people; and the My MK Heritage reveals its geocached information about a heritage site only when the app has been taken to the site. The other three also embed corporeal mobility into their use. The MK:3D app enacts the untethered gaze of much digital visuality (Rose, 2018), with the viewing body flying over and zooming into a 3D model of the city as the screen is swiped. Eyeware, meanwhile, allowed its users to imagine moving around the city with a visual impairment, and the TSC put special emphasis on how its use could enable transport hubs to be designed more inclusively. Even the Garden Monitor aims to tell gardening bodies when it is most sustainable for them to go to their garden to water it. That is, all of the apps assume (different kinds of) mobile usages.

Various reasons were given by interviewees for this emphasis on user mobility. The local transport infrastructure, and especially its fragmented and unreliable public transport system, was one motivation behind Motion Map. Others were related to the norms discussed in the previous section. Council officers and voluntary sector workers often mentioned that getting people more mobile was a means for improving public health. This was the case for MyMK Heritage, Redway Reporting, and the Breastfeeding Hub. Another reason offered by the designers of the MyMK Heritage app was that the app enabled people to learn about the city by visiting various locations: “the main intention, obviously, was to get people learning about the arts and the culture in Milton Keynes and visiting those particular spots and locations.” The third reason given for an app's focus on mobility was environmental sustainability: the Motion Map and Redway Reporting apps were also about encouraging more sustainable as well as efficient modes of transport (Valdez et al., 2018).

Aligning with these normative values, however, was an interactional value: an assumption that a body interacting with an app was a mobile body. Mobility was the corporeal sensation anticipated by interacting with these apps. Much of their data was location-specific, and interacting with it was anticipated as inducing movement. The apps' constitution of embodied mobility is also evident in the two apps attempting to commercialise their data: in both cases profits were to be made from bodies that are mobile. The plan by Motion Map's developers to charge a fee for the use of the app to bus companies and drivers makes money only from travelling bodies, and the value of user data to MyMK Heritage was the bodies it had induced into movement and (therefore, its designer assumed) health. Another example of the way that these apps were designed to extract financial value only from mobile bodies is the MK:3D Map app. This was made by the council's economic development unit to showcase investment opportunities in MK. In the early stages of the development of the Age Friendly Map, the project team hoped that the original area of the map, the Theatre District, might be incorporated into the MK:3D app. That hope fizzled out as it became apparent that the council had little interest in inserting the location of things assumed to be of interest to older people into a map visualising investment opportunities in the city.

A consequence of the valorisation of mobile bodies in the apps' environment of expected use is that bodies that do not enact this disposition towards rational mobility are rendered as a problem that has to be fixed. That is, if app interaction assumes mobile bodies, a body that is not mobile becomes “constantly problematic. It does not fit with the standardized environments that allow agency to flow without constant interruption” (Moser, 2006, p. 384). Such bodies were consistently described in interviews in terms of the aged body. The development of the prototype Age Friendly Map app for the Theatre District of central MK illustrates the constitution of this less mobile embodiment. The Age Friendly Map was initiated by MK Gallery when its outreach team realised that few “older people” were visiting the gallery, as the project lead from Age UK explained. The Gallery attempted to correct this absence by developing a prototype of an app with Arts Council funding. A specific group of older people became a key site of intervention for the Gallery:

I know when we were working with Milton Keynes MK Gallery, they were talking about hitting people within target ages. So they wanted to reach people between the 55 and 74. So that is, technically, the younger older

person. So they have, generally speaking, more stable income, their health is better, they recently retired or might be taking part in activities, and so they're people who want to get out there.

The Age UK worker's description of the "target" demographic is people "who want to get out there": they want to be mobile, and so the Age Friendly Mapp app was designed with this younger-older-but-potentially-mobile body in mind. Much of the design discussion focused on what information to provide in order to prompt these bodies into motion. The app designer was keen to include special offers for seniors in shops and cafés, for example, and the location of public toilets and benches. So, these "younger older bodies" were being constituted as poorer, more easily tired, and less continent than other bodies; but, given accessible information that ameliorated these apparent disadvantages, the app designers expected that they could become as mobile as anyone else.

The design of the app also generated much discussion about how to present that information in order to achieve this mobility. As the Age UK worker said:

you can't overload this, because if you look at a standard map, with road signs and directions and everything, there is a lot of information but it's always presented in the most simple way, because that's the most effective way.

The app designer assumed that this demographic required special effort if the information was to be accessible and therefore effective in generating mobility. As he said:

from the project outset, it was more a case of how is this age demographic, how do they react to technology? What do we need to consider to, you know, to allow them to use it easier? [...] This user has not used a tablet before, which now means that, you know, your Apple UX guidelines, your Android material design guidelines, you throw out the window, because they're for people that are familiar with apps, and to unified styles, so things are, kind of, you know, generic. They are not to cope with people that don't know mobile UI design, or aren't used to mobile design.

The design of this Age Friendly Map app demonstrates the importance to data circulations of not only what is circulated, then, but how. Interaction with data must be "easy": logical, smooth, and fast. These are versions of the embodied orientations to smart and platform interfaces discussed by Leszczynski (2019b). Just as data are assumed to travel ever faster and ever more seamlessly, so interactions with it are assumed to be immediate and on the move.

The "the app-and-person entity" (Schwanen, 2015, p. 685) being anticipated by the MK app designers can therefore be described as a mobile body, improving their self and their city by responding appropriately to the data seamlessly provided by an app. The values enacted in both interactions with data and in the anticipated outcomes of those interactions therefore normalise particular forms of rational agency and mobile embodiment. The masculinism of the idea of the rational user has already been noted. These apps are also assuming bodies on the move. This mobile body "is conceived of in terms of independence of movement and bodily functions; a body without physical and mental impairments" (Imrie, 2000, p. 1643); and if (understood as) impaired, fixable with the provision of the right kind of information presented in the right kind of way. Many feminist geographers have also noted that untrammelled urban mobility is associated most strongly with straight white masculine bodies (Mott & Roberts, 2014; Rose, 1993). The body of the app user, then, as it emerges from the normative and interactional values of the apps, is constituted as a very particular kind of corporeality.

6 | CONCLUSIONS

This paper joins a number of others in exploring an actually existing smart city. It focuses on efforts to circulate data in the city of MK using smartphone apps. Apps are by no means the only way in which data circulate in smart or platform cities, of course. However, apps are sufficiently important digital devices in smart and platform cities to warrant careful consideration. They are particular kinds of devices, though, and this paper has approached them as bodily prostheses embedded in circuits of data exchange. This understanding of apps has oriented the paper to ask what kinds of values are embedded in the design of their data flows and, in particular, what kind of embodied user is co-produced with those values.

The paper has developed a specific conceptualisation of the kinds of value generated by smartphone app data. Many of the current discussions about big smart city and platformed data have focused on the financial value that they extract from

that data by circulating it in commodity form. This is an important analysis. However, “engaging with platform services today is an integral part of being an urban citizen and as such involves many different kinds of value-sharing” (Barns, 2020, p. 17; see Lee et al., 2020). Drawing on discussions of self-tracking, this paper has suggested that there are two other forms of value that can emerge when data are produced, encountered, and shared via an app. One is the normative valuation of the anticipated outcomes of such encounters. The paper’s analysis of eight smart city apps suggested that these norms were concerned to improve the health and education of the app users, and the sustainability and place identity of the city. If “data are sets of stories” which tell, among other things, of what is valued and what is not (Neff et al., 2017, p. 85), then these norms draw on some widely shared conventions about what is necessary to promote urban wellbeing.

The paper has argued that a second kind of value is generated by the form of the user’s interaction with data. The embodied interactions between the user and the app interface are another process of value generation. In this case, there was a persistent assumption among app designers that the expected outcome of using the apps – better health, say – would materialise because users would respond to the data in a rational manner. Some discussions of an app did evoke a more affective value, as when an app was understood as part of MK’s identity as an innovatory place. But more often, a certain kind of calculative agency was being assumed as the appropriate form of user interaction with the app. This agency was consistently directed towards being mobile. Interacting with the app was assumed to be a mobile experience. The body of the app user was always anticipated to be a body on the move. If “app developers aim to get their users to do specific things – to change their behavior” (Dieter et al., 2019, p. 5), then this is done through both the norms and the interactional forms of using the app.

The values generated as data circulate through app interfaces are therefore various. They can take the form of commodities, or norms, or interactions. When these align, it is clear that certain kinds of power are enacted. The paper has been particularly attentive to the ways in which fast and seamless interactions are normatively valued as desirable, and how a specific kind of user is thus co-constituted: a user who is also on the move, as rationally and efficiently and smoothly as possible. This “naturalized normal” (Moser, 2006, p. 388) creates an implicit form of user, which aligns with a form of embodiment most often associated with able-bodied, white, masculine bodies; but it also creates abnormal bodies, who are understood as less rational or less mobile, because less responsive to the circulation of data. The commodification of data often aligns with this specific form of embodiment (Thatcher, 2017); the two MK apps that had commercial aspirations were designed to profit only from the mobile body. Moreover, the app user making rational use of data to become healthier and more educated is not dissimilar to the neoliberal forms of smart citizenship that have been so heavily criticised by many urban scholars (Rose, 2020).

Luque-Ayala and Marvin (2016, p. 202) suggest another outcome of the convergence between different kinds of value: when data flow and circulation become understood as a civic good. There were certainly some suggestions in the interviews that this is the case in MK. For the marketing manager of the visualisation company involved in the Age Friendly Map and MK:3D, accessing data appropriate to needs was a right:

You should be able to go on [to a data repository] and find out where is your dust cart or whatever you call them, bin lorries. And you should be able to go in and see how many people are in the swimming pool that you want to go to.

The notion of a right to data echoes a more radical part of the history of both smart cities and platform urbanism, which is the open data movement (Barns, 2020). Indeed, MK’s council for many years hosted an open data hub built on a Geographical Information System; anyone could register to be a user and could either interrogate the GIS directly or ask a council officer to do so for them, and users ranged from city planners to community organisers to journalists to interested individuals. Open data, then, has a history in MK which is part of the city’s wider orientation toward urban innovation. The paper has suggested that this shared sense of MK as a site of urban experimentation is very often inflected with a civic sense of public good, and was a powerful motivator for many of the app designers in MK.

The diverse values embedded in app design can have more contradictory effects too. While the MK apps reiterate very conventional notions of what Moser (2006, p. 388) calls the “competent normal subject,” this subject can turn out to be quite unruly (see also Rose, 2017). Many of the people who Age UK brought to two design focus groups for the Age Friendly app took up the notion of the mobile subject as a way to criticise the ageism of the app designer. As the project manager at the digital design company recalled:

as we found out in the focus group some of them found that quite, how do I put it, so they didn't want to rest, they didn't want to be told when they wanted to rest and they found it quite judgemental and we're saying, 'Oh public access toilets they need' and they're like, 'What are you saying, that we need to go to the toilet all the time?'

For many older people, mobility is strongly aligned with a sense of their own independence (Schwanen et al., 2012); in this case, claiming mobility for the older body was to challenge the implicit ageism of the app's data offer. All this is to suggest that the various values enacted by app data circulations need not align, and that they have diverse outcomes.

Their anticipated geographies are also diverse. The claim that the organisation of space is transduced by software code is well established (Graham & Marvin, 2001; Kitchin & Dodge, 2011), and the some of the geographies of the circulations of data in smart and platform cities have been mapped. Luque-Ayala and Marvin's (2016) account of Rio's smart operations centre, for example, describes how the centre's multiple data circulations enact a network logic of logistical control and nodal logic of territorial control; and the introduction to this paper noted how platform urbanism is often described as bifurcated into a back end of opaque data capture, analysis, and recirculation and a front end of embodied user practices. This paper suggests a more complicated geography still. On the one hand, these smartphone apps are designed with, and anticipate, a strong sense of place identity. Digital designers in and of MK have a particular sense of what their city is like and how their work aligns with that identity: inventive, experimental, innovatory. While some of this must be understood in the context of urban branding and the desire to attract inward investment to the city (and the MK:3D app was designed to facilitate just that), it also aligns with a longstanding set of institutions and discourses in the city that emphasise MK's urban uniqueness.

The paper's discussion of the anticipated user of these apps also suggests another sort of geography: of seamless mobility. The assumption that app users will be bodies on the move is not only normative. It is also interactive: it is a modality of being that is co-constituted with the flows of data through the app interface. If "constant information flow is the new nature of the city; the milieu that has to be created" (Luque-Ayala & Marvin, 2016, p. 205), then this paper has argued that bodies are as much part of this milieu as data streams and their infrastructure. Bodily mobilities are made with the data that flow through the smartphone, and while the lack of mobility is often discursively coded as a problem particularly corporealised in the older body, what is also emerging here is a differentiation between bodies based on their behaviour: do they move (enough, in the smart rational way) or not. This points to accounts of smart and platform cities which emphasise the way that their geographies are being reconfigured by the algorithmic detection of patterns of behaviour from big data rather than by conventional social categories of difference (Krivý, 2016; Rose, 2020). Indeed, accounts of interacting with data in order to become mobile in MK did seem to erase other kinds of differences between people. The designer of the breast-feeding app, for example, insisted that an app gave equal access to information and support:

I deal with teenage mums. I deal with mums who maybe have addictions or whatever, you know, all sorts of social issues and challenges. And they struggle, but nearly every single one of them will have a smartphone.

In relation to the heritage app, its designer remarked, "it's really nice to see that we've got so many different types, and so many different individuals, and families, and age groups, and ethnicities, and everything, that have downloaded and used the app." The mobilised body seems to displace many other possible ways of differentiating among appified bodies.

This group of eight smartphone applications tell much about the remaking of urban spaces and embodiments in the digitally mediated city. Many of their normative values are not surprising, though rather more diverse than many accounts of platform urbanism in particular suggest. Their interactional values are also in some ways familiar: speed, efficiency, mobility are all core to smart city imaginaries. But by unpicking these different values, this paper has suggested that while several may seamlessly align, others do not. Appified bodies are anticipated as the rational mobile body for so long associated with the white male able-bodied body, but in MK those positioned as less mobile can draw on this trope to challenge that positioning. And while much of the analysis of platform urbanism focuses on the volume and reach of big platforms, these apps point to the possibility of much more local data circulations which both assume and constitute a particular place. In such frictions between different forms of value, other appified embodiments and cities may be possible.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in the UK Data Service at <http://doi.org/10.5255/UKDA-SN-853674>, reference number 853674.

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